

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[FIFTH SERIES.]

“..... per litora spargite museum,
Naiades, et circum vitreos considite fontes:
Pollice virgineo teneros hic carpite flores:
Floribus et pictum, divæ, replete canistrum.
At vos, o Nymphæ Craterides, ite sub undas;
Ite, recurvato variata corallia trunco
Vellite muscosis e rupibus, et mihi conchas
Ferte, Deæ pelagi, et pingui conchyliis succo.”
N. Parthenii Giannettasii Ecl. 1.

No. 37. JANUARY 1881.

I.—*Spolia Atlantica: Contributions to the Knowledge of the Changes of Form in Fishes during their Growth and Development, especially in the Pelagic Fishes of the Atlantic.* By Dr. C. F. LÜTKEN*.

I.

IN this memoir I furnish a series of contributions to the knowledge of the ichthyological fauna of the high seas, principally of the Atlantic, as also to that of the hemimetamorphoses of various sea-fishes, and especially of the pelagic fishes. The changes of form and of other characters which many fishes present during their growth and development are still but little known, and have never been described in a connected manner, although in many cases they are so great and so strongly marked that they have given rise to the establishment of a considerable number of species and genera, which, as a matter of course, will disappear from the system so soon as their true relationships have been recognized. This memoir is, at the same time, to be regarded as an attempt on the part of the author to employ scientifically a portion of the abundant materials, consisting of small fishes and young

* Translated by W. S. Dallas, F.L.S., from a copy sent by the author of the French summary of Dr. Lütken's memoir, read before the Academy of Sciences of Copenhagen.

forms, especially pelagic, which, during a long series of years and by means of well-directed and persevering efforts, have been collected by Danish naturalists and by officers of the Danish royal and commercial navies. Of course, whenever I have thought it necessary for completing my investigations and making comparisons with analogous cases, I have also studied the changes produced by age in non-pelagic fishes; and equally, of course, the criticism of the genera and species to which this study has given rise has led to discussions and digressions of various nature, as also to the creation of some new species and genera. It follows that, while this memoir is especially a contribution to the knowledge of the pelagic ichthyological fauna, particularly of the intertropical Atlantic, it is also indirectly a contribution to that of the ichthyology of the deeper strata of the high seas; for the inhabitants of these depths, in the first phases of their development, very frequently ascend, especially during the night, into the warmer strata of the surface; and they are then taken in the net; or, when they are a little older, we meet with them in the stomachs of dolphins, or of voracious fishes such as the dorados, bonitos, albacores, barracoutas, sharks, &c. But the principal object of this memoir is to call attention to what I call the *hemimetamorphoses* of fishes, a phenomenon of which the pelagic fishes in particular present so many remarkable examples. In adopting this expression it is not, however, my intention to introduce into science a new notion or a new term; I employ it solely to characterize briefly the changes which are produced during growth and development, which in many cases are so considerable that they have led to the complete misunderstanding of the genus, nay, often even of the family to which the young individuals belong. I hope by this means to profit science by a series of rectifications consisting in great part in the reduction of genera and species which are based only upon young, transitory forms. In many cases I shall thus be led simply to confirm or extend the observations of my predecessors, in other cases to reject or rectify conjectures or combinations which are destitute of foundation. One of the consequences of a work of this nature may perhaps also be that, in future, we shall proceed with more circumspection and critical judgment in establishing new species and genera, considering the possibility that the differences which may be recognized are due solely to differences of age. The mistake has only too often been made of regarding the latter as specific or generic differences; and this, in general, has rendered the estimation of the true distinctive characters all the more difficult.

In the following summary of the principal facts and results which are set forth in my memoir, I have followed the order of the chapters in the Danish text.

1. DACTYLOPTERUS and CEPHALACANTHUS.

As is well known, M. Canestrini has endeavoured to prove that *Cephalacanthus spinarella* (*Pungitius pusillus*) is the young form of *Dactylopterus*. This opinion was apparently well founded; but it has been contested by M. Steindachner, principally with the argument that we may meet with *Dactylopteri* a little smaller than the largest of those which still present the characters of *Cephalacanthus*. Having had at my disposal, on the one hand, a series of twenty-five specimens of *Dactylopterus volitans* of all sizes, from 380 to 47 millims. in length, the last with the wings still short, and, on the other hand, almost as many of *Cephalacanthus spinarella* (twenty-three), also of all sizes, from 49 to 8 millims. long, I have studied in these two series all the characters subject to modifications arising from differences of age, in order to discover whether the changes which the *Cephalacanthi* had undergone enabled us to ascend to the *Dactylopteri*, and reciprocally those of the latter to descend to the *Cephalacanthi*, or whether these fishes constituted two series of forms independent of each other. The result of these comparisons (for the details of which I must refer the reader to the Danish memoir) has been, so far as I am concerned, an absolute confirmation of M. Canestrini's hypothesis. We may certainly find *Cephalacanthi* a little larger than the smallest *Dactylopteri*; but this is easily explained by the fact that the metamorphosis properly so called, which no doubt takes place comparatively quickly, does not always occur precisely when the young fish has attained a definitive length (about 50 millims.), but may, according to circumstances, occur in a given individual a little sooner or a little later. It may be added that the localities (latitude and longitude) where our young *Dactylopteri* or so-called *Cephalacanthi* were taken seem to prove that this genus possesses the character of a semipelagic genus in a greater degree than has hitherto been supposed. It appears also, from the investigation that I have made of its development, that the small anterior part of the pectoral fins in *Dactylopterus* is, properly speaking, the superior and not the inferior part, as has hitherto generally been stated.

2. RHYNCHICHTHYS, RHINOBERYX, and RHAMPHOBERYX; HOLOCENTRUM and MYRIPRISTIS.

The hypothesis has already been advanced that *Rhynchich-*

thys pelamidis, C. & V., and other species of *Rhynchichthys* subsequently established are young *Holocentra* (or *Myripristes*) ; and the correctness of this view is now confirmed by the circumstance that it has been possible to refer several small examples of "*Rhynchichthys*" and "*Rhinoberyx*" of different ages, fished in the western part of the intertropical Atlantic, to a definite species of *Holocentrum*, the *H. marianum* of the Antilles, which, however, has hitherto been very imperfectly described. We are acquainted with it now in all the phases of its development :—as the true *Holocentrum*, young and adult ; as "*Rhinoberyx*," a phase intermediate between the *Holocentrum* and the "*Rhynchichthys*;" and, finally, in this last and very young state.

In the Danish memoir I have described in much detail the characters of the species in each of these phases, comparing them both among themselves and with the corresponding states of *Holocentrum sogho*, another common West-Indian species, of which we possess an almost equally complete series of forms. The "*Rhamphoberyx*" is probably the corresponding young form of *Myripristis*. These three genera (*Rhynchichthys*, *Rhinoberyx*, and *Rhamphoberyx*) must therefore be suppressed, with the species belonging to them ; and we may say the same of certain species such as *Holocentrum platyrhinum*, which are also young forms of which the transformation is not completed, but which, instead of being referred to separate genera, have only been placed in a special group of the genus *Holocentrum*.

But at the same time I have been able to recognize a phase of development anterior to that which serves as the basis of the genus *Rhynchichthys*. A small fish, 7 millims. long, which is undoubtedly the young form of a West-Indian *Holocentrum*, perhaps even of *H. marianum*, is distinguished from the true "*Rhynchichthyes*" by a forked beak, the comparatively great length of which is equal to twice the diameter of the eye, and by the occipital spine, which is very strongly developed, as well as those of the præoperculum, which last extend much beyond the ventral fins, as far as the middle of the anal. Our museum possesses very young larvæ of Berycidæ (that is to say *Rhynchichthyes*) from the Indian Ocean, which much resemble the preceding form ; but in others, which otherwise have an analogous structure, the beak, which is sometimes comparatively short and sometimes extremely elongated, does not present the remarkable division in the form of a fork. Considering the numerous representatives of this family in the Indian seas, it is impossible at present to determine these young forms more exactly.

The primordial but transitory characters which distinguish the young *Holocentra* and *Myripristes* are therefore :—1. The more or less excessive prolongation of the bones of the snout in the form of a pointed beak, entire or cleft in two, with denticulated edges, and comparatively as large as the sword of the swordfish; and 2. The colossal development of the occipital and præopercular spines, as also, in part, of those of the operculum. These spines, however, soon disappear or become reduced to more modest proportions, or to perfectly insignificant rudiments.

3. TETRAGONURUS.

This very characteristic genus, which is thoroughly pelagic and probably bathyphilous, inhabits the Atlantic, where it is frequently found in the stomachs of large voracious fishes or dolphins; and young individuals are often taken by the net. *Tetragonurus atlanticus*, Lowe, is certainly specifically identical with *T. Cuvieri*, K. The differences they present are in part purely individual, in part differences arising from age. Young individuals (32-62 millims.), leaving out of consideration certain modifications in the relative proportions of the parts of the body, which are mentioned in detail in the Danish memoir, are distinguished (1) by the spinous or denticulate opercular and præopercular bones, and (2) by the different character of the scales, which much resemble those of the young swordfish, and have only a single sharp keel (the scales of the lateral line, however, have two), which terminates in two or three spines recurved backward, giving the young *Tetragonurus* a rough or villous aspect. The youngest examples (16 millims.) have neither scales nor spines on the skin; and their ventral fins are extremely short, nay, even rudimentary. I have also discussed the question of the place to be assigned to *Tetragonurus* in the true natural system. We shall seek in vain for indications of relationship with *Mugil* or *Atherina*; the proposition of Lowe and Swainson to refer it to the Scomberoids is perhaps that which is most in accordance with nature.

4. XIPHIAS and HISTIOPHORUS (TETRAPTURUS).

The young forms of the Xiphioids are already so well known, thanks especially to Dr. Günther's communications, that the series of small individuals of the two types that I have had at my disposal do not enable me to add much that is new; nevertheless I have been able to carry the evolution of the two groups a little further, to a phase which must be very near the exclusion from the egg. The two principal

types (*Xiphias* and *Histiophorus*) differ from each other quite as much in their youth as at a later period in the external characters and the structure of the skeleton. I have already shown elsewhere (Vidensk. Medd. f. d. naturh. For. 1875) that of these two types the *Histiophori* represent the typical group properly so called, or the central group, whilst the *Xiphiæ* must be regarded as a divergent branch or "aberrant type," and that the species, so far as one can form an opinion upon this point from the data furnished by the literature, seem to be few in number, less numerous, in fact, than has hitherto been supposed, but that they are almost cosmopolitan in their geographical distribution. Probably we know only five in all—namely, two *Tetrapturi*, two *Histiophori*, and one *Xiphias*. *Machera*, C. & V., is in every respect a true *Histiophorus* without ventral fins; and we cannot help suspecting that the asserted absence of the latter is founded upon an error or due to the preparer. The small species of *Histiophorus* which have been established, *H. immaculatus*, Rüpp., and *H. pulchellus*, C. & V., are evidently only young forms (they measure respectively 18 and 4 inches), of no true specific value; and *H. pulchellus* particularly closely approaches the young *Histiophori* of $5\frac{1}{2}$ to 60 millims. length, examined by Dr. Günther and by myself. For these last I refer the reader to the Danish text, the most important facts relating to them being already known; but some remarks upon the young *Xiphiæ*, and upon the characteristic differences which distinguish them from the young *Histiophori*, will be necessary. Thus, one of our young swordfish (*Xiphias*) 190 millims. long, found in the stomach of an albacore, and consequently imperfectly preserved, has a very slender form; the mandible is only 12 millims. shorter than the rostrum, which is convex above and flat beneath, like that of a *Tetrapturus*, and twice as broad as high; the branchiæ present nothing remarkable, and consequently have not yet acquired the character which distinguishes those of the Xiphioids. The two jaws are well armed with comparatively strong teeth. All the body (including the head and the rostrum) is clothed with non-imbricated scales, which are keeled and ciliated—that is to say, furnished with spines or teeth upon the keel. Two rows of these scales, which strike one by their size, extend along the back on each side of the dorsal fin, and two others along the belly on each side of the anal fin. The scales are still very distinct in the young *Xiphias gladius* 700 millims. long, in which one may even easily recognize and trace the rows of large scales above mentioned; on the other hand, this covering, at least as regards the teeth of the scales, occurs even in the youngest

Xiphias observed, 10 millims. in length. In contrast to this, all the young *Histiophori*, from $5\frac{1}{2}$ to 100 millims., are completely naked and destitute of scales. Thus we cannot compare with the scales of the young *Xiphie* those of the adult *Histiophori* and *Tetrapturi*, which are perfectly homologous with those of the Thynnoids. The young examples of *X. gladius*, from 37 to 57 millims., are adorned with transverse bands, like many other small Scomberoids; the frontal margins and the præoperculum are denticulated; and the latter is also, in the youngest individuals, furnished with a group of spines, as in many other young Scomberoids. We never find in them any traces of ventral fins, whilst these are never wanting in the *Histiophori*, and always occur, in a rudimentary state, even in the youngest. Then, in the youngest *Xiphias*, the head is flat without presenting the sudden depression of the forehead which characterizes the *Histiophori*, the rostrum is short, and broad at the base, and the mandible as long as the upper jaw. Finally, the *Xiphie*, in all their successive stages, present nothing comparable to the occipital and præopercular spines, so enormously developed in the young *Histiophori*, and which resemble those of the *Dactylopteri*.

It would be far from natural to exclude the Xiphioids from the great family Scomberoidei, in which they find their most strongly marked affinity in the genus *Acanthocybium* (*vide infra*, p. 12). The more detailed classification of the Scomberoidei has still to be settled. As to ranging them with Cottoidei ("Cotto-Scombriformes") I have never been able to convince myself that there was any thing just and natural in that classification.

5. TRICHIURUS and GEMPYLUS.

Under the denomination of Trichiuridæ Dr. Günther has united two tribes which are certainly related in a certain degree, but which nevertheless are clearly distinguished from each other. These are the true Trichiuridæ (*Trichiurus*, *Lepidopus*, *Aphanopus*, and *Euoxymetopon*) and the Gempylidæ or Thyrsitidæ (*Gempylus*, *Prometheus*, *Epinnula*, *Nesiarchus*, *Nealotus*, and *Thyrsites*). The latter must be united with the Thynnidæ, but may nevertheless form a secondary group among them.

With regard to the genus *Trichiurus* I will, in the first place, remark that the species that it includes at present do not all appear to me capable of being maintained; but I shall not pronounce a definite opinion upon this point, as the materials at my command are insufficient. It is evident that the two types represented by *T. lepturus* and *T. muticus* differ

in a whole series of well-marked characters, but that the generic separation between the *Lepturi* (*Trichiurus lepturus* and the allied species) and the *Eupleurogrammi* (*T. muticus*) proposed by Gill is unnecessary, and therefore to be rejected. The specific difference between *T. lepturus* of the Atlantic and *T. haumela* of the Indian Ocean seems to me not to repose upon a very solid basis; and how far the latter is really a species distinct from *T. savala* is a question which I shall also leave undecided. But there are two points which merit attention, namely:—1, that *T. muticus* also occurs in the Atlantic, where it had not hitherto been indicated (I have before me a specimen from Cuba which I am unable to distinguish from those from Tranquebar); and 2, that in a *Trichiurus* (*haumela*?) 52 millims. long, from Java, I have found, in the place of the ventrals, which are usually deficient, two denticulated spines 2 millims. in length (just as, for example, in the young *Prometheus atlanticus*). These spines, which evidently represent the ventrals, probably exist in all the young *Trichiuri*; but they persist only in *T. muticus*, in the shape of small rudiments in the form of scales, and disappear entirely in the other species.

The Gempylides and the Thyrsitides present an osteological peculiarity which has generally passed unnoticed; I refer to a system of dermal ribs, or subcutaneous accessory ribs, composed of delicate bony filaments, placed pretty close together, which are directed backwards, and both upwards and downwards, and start from the median line on both sides of the body, forming acute angles with each other. I have observed them in *Thyrsites atun* (*chilensis*), in *Nealotus tripes*, and in both large and small examples (down to a total length of 78 millims.) of *Gempylus serpens*. I have been able to study the last-named species, which is essentially pelagic and rare in museums, in all the phases of its development, from a length of about 1 metre down to a total length of only 9 millims., a phase which must have almost immediately succeeded the hatching of the egg. The species established, namely *G. coluber* (genus *Zyphothyca* of Swainson) and *G.* or *Prometheus* (*Nealotus*) *ophidianus*, Poey, do not differ specifically from *G. serpens*; but the characters of this genus are not correctly indicated, even in the most recent works. Thus the skin is not entirely destitute of scales: we find in it a rudiment of the "corselet," not only behind the eyes, but also at the root of the tail; and from this point the clothing of scales continues in part for a small extent along the inferior lateral line, in part for a greater extent along the back, forming a band which is limited inferiorly by the superior

lateral line, which in the anterior part of the body unites with the inferior, at a point situated beneath the first dorsal spine. The palatine bones in their posterior part are armed each with three or four small teeth; and the ventrals are formed by one spinous and four soft rays. In the earliest phases of their development the *Gempyli* have so different a physiognomy that it would be difficult or impossible to recognize them for what they are if one did not know the intermediate stages. The body is short and thick-set; the first dorsal attains its greatest elevation in front, and then decreases rapidly; we find two free spines in front of the anal fin; the denticulated spines of the ventrals are comparatively very long, as long as (and even longer than) the spines of the dorsal; there are neither scales nor lateral line; nor are the finlets distinguishable; the operculum and præoperculum are spinous. For what relates to the course of the development and transformation I refer the reader to the figures on pl. iii. [of the Danish memoir]. I have also described and figured some very analogous stages of development in a fish of the *Thyrsites* tribe, perhaps *Nealotus tripes*. *Dicrotus armatus*, Günther, is certainly an analogous transitory form, probably of *Prometheus atlanticus*.

6. THYNNUS; ORCYNUS; PELAMYS; CYBIUM and ACANTHOCYBIUM.

In the group Thynnidae I distinguish the following genera:—*Orcynus*, *Thynnus*, *Auxis*, *Orcynopsis*, *Pelamys*, *Cybius*, and *Acanthocybius*. I must leave on one side certain other genera which have been established, because I do not know them—for example the genera *Grammatorcynus*, Gill (*Thynnus bilineatus*), *Lepidocybius* and *Apodontis*, Benn.; the separation of these two last genera from *Cybius* seems to me, however, to be not well founded. *Gymnosarda* Gill (*Pelamys nuda*) will no doubt prove to be a synonym of *Orcynopsis*, G. (*Pelamys unicolor* = *Thynnus peregrinus*, Coll.*); even the specific differences which serve as the basis of these two genera are rather uncertain, and will need to be confirmed, although one of the two species is a native of the Mediterranean (it has been once found in the North Sea) and the other of the Red Sea.

I retain the name of *Thynnus* † for “the small tunnies,”

* M. Giglioli has recently proposed for this genus the name of *Pelamichthys*, which, however, must yield priority to that proposed by Mr. Gill.

† M. Giglioli designates this generic division by the name of *Thynnichthys*, a very happy denomination, but one which has already been employed for a genus of Cyprinoids.

the bonito (*T. pelamys*) and *T. thunnina*, a species from which *T. affinis* probably does not differ; and I reserve that of *Orcynus* for "the large tunnies"—that is to say, the true tunny (*O. thynnus*) and the "germon" or albacore of our sailors (*O. germo*), a species which is rendered recognizable by the long pectorals and the prolongation in a sabre-like form, in the adult, of the second dorsal and the anal. These four species are all extremely cosmopolitan in their geographical distribution (which also seems to be the case, although in a less degree, with *Auxis*); those of the whole group which have the pelagic character most strongly marked are *Orcynus germo* and *Thynnus pelamys*. A critical revision of the species described under other names, a revision founded on the comparison of individuals of different sizes belonging to several of the four principal types above mentioned, has convinced me, or at least rendered it very probable, that most of these species must be eliminated, as resting only upon quite secondary differences, to a great extent arising from age. Thus *T. brachypterus* is without the least doubt nothing but a young form of *Orcynus thynnus*, and *T. brevipennis* a still younger form of the same, or rather a corresponding form of *T. thunnina*. I must here remark that the want of the swimming-bladder, which is generally attributed to the true tunny, is apparently founded on a mistake; it is described in detail by M. Malm in his 'Fauna of Bohuslän.' Further, I have no hesitation in identifying *Thynnus secundodorsalis*, Storer, and *E. orientalis* from Japan with *O. thynnus*; *Thynnus coretta* is a form intermediate between *Orcynus thynnus* and *T. brachypterus*, and may consequently also be struck out of the catalogue. With *Orcynus germo* (*pacificus*), again, I identify *T. alalonga*, *albacora*, *argentivittatus*, *balteatus*, *sibi*, and *macropterus*, which inhabit different parts of the great ocean; but I hesitate about including in this suppression of species *O. subulatus*, Poey, of Cuba, and *O. pacificus*, Cooper, of California,—the former on account of its pectorals, which are singularly short for an albacore; the latter, on the contrary, on account of extraordinary prolongation of these same fins. At any rate the characters ascribed to these two forms of albacores require confirmation in this respect. As to the generic separation of the albacores, with long pectorals, from the true tunnies, with shorter pectorals, there seems at present no reason for making it. From these forms, which I unite under the generic denomination of *Orcynus*, the "small tunnies" (*Thynnus* s. str. m.) differ:—1, by the absence of teeth on the vomer, a character which has hitherto passed entirely unnoticed, but to which, in the group of the Thynnidæ, generic

value has generally been accorded; 2, by the complete absence of scales outside the corselet, whilst in the *Orcyni* of the same size the skin is already clothed with small scales, the consequence of which is that the limits of the "corselet" in the adult tunny and albacore are somewhat obscure, so that, properly speaking, we cannot say there is a distinct corselet in those species; 3, by an important osteological character, namely the special development, in the form of a net or trellis, of a portion of the abdominal part of the vertebral column between the vertebrae properly so called and the hæmapophyses, a development which has already been described by Cuvier. This organization is common to *T. thunnina* and *T. pelamys*, and occurs in a modified form in *Auxis*, while in this respect *Orcynus germon* presents essentially the same character as *O. thynnus* and the species belonging to the genera *Cybius* and *Pelamys*. Whether this is or is not the case in *Orcynopsis (unicolor)* is unknown; but there is reason to suppose that it presents some of the characters belonging to *Auxis* and to *Thynnus* (m.).

Pelamys chilensis and *P. orientalis* are certainly not different species, any more than *Thyrssites chilensis* and *T. atun*. It is by error also that a corselet of scales has been denied to the genus *Cybius*; this is already distinct in very young individuals, and extends, in the usual way, round the base of the pectorals and ventrals, along the dorsals, &c.; but, it is true, it is less apparent than in the other Thynnoids. The species included in the genus *Cybius* differ in general by rather insignificant characters, which, however, seem to be more constant than might have been expected. There is therefore no reason for reducing them in the same proportion as the species of the *Thynnus-Orcynus* group; moreover it would appear that they are far from being so pelagic as the species belonging to the latter group. Among the species of *Cybius* proper inhabiting the Atlantic, I have been able to distinguish without difficulty *C. caballa* (of which *C. immaculatum* is no doubt the young form), *C. regale*, and *C. maculatum*; *C. acervum* is a young *C. regale*, and has nothing to do with *C. caballa*.

There is, however, a species of *Cybius* which must be generically separated from the rest, namely the large truly pelagic and rather rare Thynnoid, attaining a length of more than seven feet, which our sailors call the "barracotta," and of which they have sometimes brought us the head and caudal fin; it is met with in the Atlantic north and south of the equator, in the Mediterranean, and in the Pacific Ocean, but much more rarely than the bonitos and albacores. It is the

Cybius Solandri, C. & V., *C. petus*, Poey, the type of the genus *Acanthocybius*, Gill, and recently described by M. Doderlein under the name of *C. Verany*. This genus is clearly distinguished from the true *Cybius*:—1, by the long and pointed form of the head, in which the mandible is longer than the upper jaw, the cleft of the mouth reaches only to beneath the eye, and the posterior part of the maxillary is not visible but concealed by the suborbital plate; the jaws are armed with a close series of cutting-teeth lancet-shaped and finely crenulated; 2, by the branchiæ, which exactly resemble those of *Xiphias*, their leaves being soldered together in the form of a network; 3, by the distance between the points of the caudal fin, which scarcely exceeds the length of the head, &c. That *Acanthocybius* is the Thynnoid form most nearly approaching the swordfish is shown by the peculiar modification of the branchiæ and the prolongation of the intermaxillaries, which, if more developed, would become the short rostrum of *Tetrapturus belone*. This genus thus acquires peculiar importance from a systematic point of view; and a detailed investigation of the still unknown structure of its skeleton would be especially desirable.

I have regarded as belonging to *Orcynus germon* some small Thynnoids of 8–17 millims. long, fished in the open sea. The corselet and the keels of the tail are wanting; the finlets are only just indicated in the largest specimen, and are not distinct; there is no trace of them in the others, which are distinctly heterocercal and perfectly colourless, with the exception of the eyes and the first dorsal, which are black. The præoperculum is armed with spines in all.

7. CORYPHÆNA EQUISETIS, L., C. HIPPURUS, L., and C. FASCIOLATA, Pull.

The genus *Coryphæna* (the “dolphins,” as our sailors call them) is one of those which have the pelagic character most strongly marked; at the same time it furnishes an example *instar omnium* of the extreme confusion that has resulted from the circumstance that a really very limited number of existing species has been broken up into a great number of nominal species which are based only upon differences of age and sex, upon individual peculiarities, different geographical localities, incorrect drawings, imperfect descriptions, &c., a confusion for which, however, George Cuvier has been wrongly made personally responsible. The error committed in dividing the species into two genera, *Coryphæna* and *Lampugus*, has already been rectified by a competent authority; and the number of species reputed well established has, at the same

time, been reduced from nineteen to six. I have no doubt, however, that this number is still too great, and that it must be limited to two or, at the most, to three—the two old Linnæan species, “the great dorado” (*C. hippurus*), which attains a length of nearly 2 metres, and “the little dorado” (*C. equisetis*), the size of which does not exceed $2\frac{3}{4}$ feet. In the Danish text I have given comparative characters of the two species, taking into account especially the changes which they undergo with age during their growth, as well as those which, at least in *C. equisetis*, are a consequence of sex, and I have illustrated by figures the modifications which are produced in the two species in the form of the head. Most of the species described and figured by authors may, without much difficulty, be referred to the two cosmopolitan species in question, which our sailors have frequently brought us, and which are the only ones that they have been able to present to us. I must, however, speak with some little reserve of the *C. pelagica* (*azorica*, *sicula*) of the Mediterranean, which has been adopted by most of the authors who have paid attention to the ichthyology of that sea, but which, nevertheless, probably does not differ specifically from *C. hippurus*, L.; at least I was obliged to regard as a young individual of the latter species a small “*C. pelagica*” from the Mediterranean which was kindly submitted to my examination under the above name by an Italian museum. In support of my opinion, that in reality there exist only two species of *Coryphæna*, I will cite two other circumstances:—one that Dr. Günther (although he formally recognizes more) really refers all the specimens at his disposal to these two species, and thus in fact only recognizes these; the other, that I have been able without difficulty to arrange the numerous examples of young *Coryphæna* from 18 to 62 millims. long, captured by our mariners, in two series representing two species, and to refer these series to the two species in question and to no others—namely, the more numerous one to *C. equisetis*, and the less numerous to *C. hippurus*. Further, the young *Coryphæna* have so little resemblance to the adults in the matter of habit, that they may easily give rise to mistakes; it is thus that a young *C. hippurus* was described by Pallas under the name of *C. fasciolata*. I have given comparative descriptions of young individuals of the two species in their successive stages and in their relations to the adults; and I shall here confine myself to referring to the figures on my pl. iii., only remarking that the greater length of the ventrals in *C. hippurus*, and especially their attachment beneath the pectorals, more forward than in *C. equisetis*, furnish one of the best

means of separating from each other the young individuals of the two species, and agree with one of the best distinctive characters of the adults. The very small examples of both species not only have the præoperculum furnished with spines, but they have also a scapular spine and a postsupraorbital spine on each side. The larger specimens have a rather elongate form, but are at the same time pretty thick, and not compressed as at a later period; the dorsal, which is comparatively rather low, originates, in the adult *C. equisetis*, at a point not far distant from the posterior margin of the eye, in young individuals above the posterior margin of the præoperculum, in still younger individuals between the latter and the gill-cleft, in the adult *C. hippurus* above the posterior margin of the pupil, in the youngest individuals above the gill-cleft, &c. The system of coloration which distinguishes the different ages of these two species will be easily understood by the aid of the figures.

[To be continued.]

II.—*On some new or imperfectly-known Species of Corals from the Devonian Rocks of France.* By H. ALLEYNE NICHOLSON, M.D., D.Sc., F.R.S.E.

[Plate I.]

SOME little time ago M. Daniel Œhlert, the able Curator of the Museum of Natural History in Laval, was good enough to send me for examination and determination a number of corals from the inferior Devonian deposits of the neighbourhood of Laval, the stratigraphical and palæontological relations of these deposits having been made by him a subject of special study. Among the specimens contained in the collection submitted to me were some entirely new forms, as well as some which have not yet been fully worked out; and I propose on the present occasion, in accordance with M. Œhlert's wish, to give a brief description of the more important and striking of these.

Endophyllum Œhlerti, Nich.

Spec. char. Corallum composed of subcylindrical corallites, which are either not in contact at all or, at most, touch each other only at limited portions of their circumference. The diameter of the corallites along their longest axis is from 20 to 25 millims. Each corallite is enveloped in a distinct